PUSAT PENGAJIAN TEKNOLOGI INDUSTRI

UNIVERSITI SAINS MALAYSIA

BORANG PENYERAHAN DISERTASI MUTAKHIR

SATU (1) NASKAH

Nama penyelia: DR EFFARIZAH MOHD ESAH

Bahagian: TEKNOLOGI MAKANAN

Saya telah menyemak semua pembetulan/pindaan yang telah dilaksanakan oleh Encik/Puan/Cik NOR AFIQAH BINTI AHMAD

mengenai disertasinya sebagaimana yang dipersetujui oleh Panel Pemeriksa di *Viva Voce*-nya.

2. Saya ingin mengesahkan bahawa saya berpuashati dengan pembetulan/pindaan yang dilaksanakan oleh calon.

Sekian, terima kasih.

(Tandatangan dan cop)

7 Ogos 2020

Tarikh

SURVIVAL AND HEAT RESISTANCE OF *Salmonella enterica* serovar Weltevreden IN BLANCHED VEGETABLES AT DIFFERENT TEMPERATURES

by

NOR AFIQAH BINTI AHMAD

A dissertation submitted in partial fulfillment of the requirements for the Degree of Bachelor of Technology (B.Tech) in the field of Food Technology

School of Industrial Technology

Universiti Sains Malaysia

July 2020

DECLARATION BY AUTHOR

This dissertation is composed of my original work and contains no material previously published or written by another person except where due reference has been made it the text. The content of my dissertation is the result of the work I have carried out since the commencement of my research project and does not include a substantial part of my work that has been submitted to qualify for the word of any other degree or diploma in any university or other tertiary institution.

Nor Afiqah Binti Ahmad

July 2020

ACKNOWLEDGEMENT

First of all, I would like to thank the School of Industrial Technology, Universiti Sains Malaysia, for giving me the opportunity to complete my Final Year Project (FYP) and to allow the use of the facilities and equipment provided. I very much appreciate all the facilities, equipment and materials and other resources that have been given to complete my research study.

In addition, I would also like to express my sincere appreciation and thank you to Dr Effarizah Mohd Esah, my final year project supervisor, who has given me feedback and guided me on the way to the completion of my final year project.

Next, I would like to thank the microbe laboratory assistant, En. Abdul Ghoni Ruslan, who taught and provided guidance for me throughout I am doing the experimental laboratory work.

I would also like to thank my fellow course mates and friends who encourage me and share helpful ideas, guidance and information on my way to the end of this project. Last but not least, I would like to thank my dearest family for their moral support, encouragement and motivation.

Nor Afiqah Binti Ahmad

July 2020

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

Symbol	Caption
°C	Degree Celsius
±	Plus-minus
≥	Greater than or equal to
<	Less than
>	More than
%	Percent

Abbreviation	Caption
μL	Microliter
ATR	Acid Tolerance Responses
a_w	Water Activity
CDC	Center for Disease Control and Prevention
CFU	Colony Forming Units
DNA	Deoxyribonucleic Acids
D-value	Decimal reduction time
FDA	Food and Drug Administration
g	Gram
Hrs.	Hours
mL	Milliliter
NA	Nutrient Agar
NB	Nutrient Broth

R.H	Relative Humidity
RNA	Ribonucleic Acids
rpm	Revolutions Per Minute
secs	Seconds
SD	Standard Deviation
spp	Species
UV	Ultraviolet
vs	Versus
XLD	Xylose-Lysine Deoxycholate

LIST OF APPENDICES

KELANGSUNGAN HIDUP DAN RINTANGAN HABA *Salmonella enterica* serovar Weltevreden DALAM SAYUR-SAYURAN YANG DICELUR PADA SUHU YANG BERBEZA

ABSTRAK

Pengambilan sayur-sayuran segar yang melalui proses minimal tanpa rawatan haba agak berisiko kerana sayur juga mengandungi banyak mikroorganisma asli dan patogen seperti *Salmonella* yang boleh menyebabkan keracunan makanan. Penceluran adalah rawatan haba yang dilakukan pada sayur bagi mengurangkan dan menghapuskan mikroorganisma yang terdapat pada sayuran. Walaubagaimanapun, rawatan haba yang tidak mencukupi semasa mencelur boleh menyebabkan mikroorganisma mampu bertahan. Kajian ini dilakukan untuk mengetahui rintangan haba *Salmonella* Weltevreden dan kelangsungan hidupnya setelah dicelur dengan sayuran berbeza iaitu tauge dan kangkung pada suhu yang berbeza iaitu pada 70 °C, 75 °C, 85 °C dan 100 °C. Sampel sayur yang digunakan diinokulasi dengan inokulum *Salmonella* Weltevreden terlebih dahulu sebelum dicelur mengikut suhu dan selang masa yang ditentukan iaitu pada 15, 30, 60, 90 dan 120 saat bagi suhu 70 °C dan 75 °C manakala 5, 10, 15, 20, 25, 30 dan 60 saat bagi suhu 85 °C dan 100 °C. Hasil dalam kajian ini menunjukkan bahawa populasi *Salmonella* Weltevreden yang terselamat setelah menjalani proses penceluran terhadap semua suhu semakin berkurang sehingga tiada lagi populasi terselamat yang dapat diperhatikan apabila selang masa dan suhu yang digunakan ketika proses mencelur semakin bertambah. Nilai-D sampel tauge setelah dicelur pada 70 °C, 75 °C, 85 °C dan 100 °C masing-masing sebanyak 25 saat, 14 saat, 10 saat dan 9 saat. Manakala nilai-D bagi sampel kangkung setelah menjalani proses mencelur pada suhu 70 °C ialah 31 saat, dan nilai-D pada 75 °C, 85 °C dan 100 °C dianggarkan semakin berkurang daripada 31 saat kerana eksperimen

hanya sempat dilakukan pada 70 °C sahaja. Melalui penceluran, populasi pengurangan *Salmonella* Weltevreden pada sampel tauge ialah 5-log pengurangan *Salmonella* dicapai setelah dicelur pada 70 °C dalam tempoh 120 saat. 6-log pengurangan *Salmonella* dicapai ketika dicelur pada 75 °C dalam tempoh 90 saat. Manakala 5-log pengurangan *Salmonella* dicapai dalam tempoh 60 saat bagi kedua-dua suhu 85 °C dan 100 °C. Untuk sampel kangkung, sebanyak 3-log pengurangan *Salmonella* dicapai dalam 120 saat pada 70 °C. Terdapat perbezaan signifikasi bagi setiap suhu digunakan semasa mencelur terhadap populasi *Salmonella* Weltevreden bagi sampel tauge. Untuk sampel kangkung, tiada perbezaan signifikasi bagi suhu digunakan semasa mencelur terhadap populasi *Salmonella* Weltevreden. Rintangan haba *Salmonella* ditentukan dengan mengukur nilai-D bagi sampel sayur digunakan. Nilai-D semakin berkurang apabila suhu semasa dicelur meningkat.

SURVIVAL AND HEAT RESISTANCE OF *Salmonella enterica* serovar Weltevreden IN BLANCHED VEGETABLES AT DIFFERENT TEMPERATURES

ABSTRACT

Consumption of fresh vegetables that undergo minimally processed without heat treatment is quite risky as the vegetables also contain indigenous microorganisms and other pathogens such as *Salmonella* that may cause food poisoning. Blanching is the heat treatment applied to the vegetables to reduce and eliminate the microorganism that presents on the vegetables. However, insufficient heat treatment during blanching may cause the microorganism able to survive. This study was performed in order to determine the heat resistance of *Salmonella* Weltevreden, its survival after blanched in different vegetables used which were the bean sprout, and water spinach samples with different temperatures at 70 °C, 75 °C, 85 °C and 100 °C. Survivor of *Salmonella* Weltevreden and the D-values can be determined after blanched. The vegetable samples used were inoculated with the *Salmonella* Weltevreden inoculum before undergoes the blanching process according to specific temperatures and interval times which were 15, 30, 60, 90 and 120 secs at both 70 °C and 75 °C while 5, 10, 15, 20, 25, 30 and 60 secs at both 85 °C and 100 °C. The results in this research shown that the survivor population of *Salmonella* Weltevreden after blanched at all temperatures becomes decreased until no more survivor population can be observed when both of interval times and temperatures used during blanching was increasing. Besides, the D-value achieved for bean sprout samples after blanching at 70 °C, 75 °C, and 85 °C and 100 °C were 25 secs, 14 secs, 10 secs and lastly 9 secs respectively. While the D-value of water spinach after blanched at 70 °C was 31 secs and the expected D-values at 75 °C, 85 °C and 100 °C becomes

decreases from 31 secs respectively as the experiment only managed did at 70 °C only. Therefore, through the blanching, the reduction population of *Salmonella* Weltevreden in inoculated bean sprout samples determined were a 5-log reduction of *Salmonella* achieved after blanching at 70 °C within 120 secs. A 6 log-reduction of *Salmonella* achieved within 90 secs when blanched at 75 °C and for both temperatures at 85 and 100 °C, 5-log reduction was achieved within 60 secs. For inoculated water spinach samples, 3-log reduction of *Salmonella* achieved within 120 secs after blanching at 70 °C. There was a significant different among the treatment used for every temperatures during blanching with the population of *Salmonella* Weltevreden for inoculated bean sprout samples. For water spinach samples, there was no significant different among the treatment used for temperature during blanching with the population of *Salmonella* Weltevreden. The heat resistance of *Salmonella* Weltevreden determined by the measuring the D-values vegetables samples used. The D-values became decreases when temperatures used during blanching increase.